REMARKS

Claims 1-4, 6-11, 15-17, 30, 32-35, 37-44, 48-69, 73-80, and 83-85 now remain in this application. Claims 1, 6, 10, 11, 30, 35, 37, 40, 41, 60, 62, 63, 74, 75, 79, 83 and 84 have been amended. Claim 5 has been canceled.

Claims 1-11, 15-17, 30, 32-35, 37-44, 48-69, 73-80, and 83-85 were rejected under 35 USC 103.

Claim Rejections - 35 USC § 103

First Rejection: Claims 1-5, 44, 48-59 and 73-80 are rejected under 35 USC 103(a) as being unpatentable over Henley et al. (US Pat. No. 6,321,134) in view of Ishii et al. (US Pat. No. 5,571,366).

Claim 1 recites a plasma immersion ion implantation process in which plasma source power and plasma bias power are coupled into a plasma chamber, and the ion implantation depth is controlled by controlling the plasma bias power (or voltage) level (see applicants' specification page 76 line 6). Although not specifically recited in the claim, this combination enables the independent control of ion implantation dose and ion implantation depth (specification page 77 lines 17-22): the dose is controlled by the plasma RF source power applied to the inductively coupled source power applicator while the implant depth is controlled by the RF bias power (or voltage) applied to the workpiece.

Typically, the RF bias voltage must be very high, higher than an etch process reactor, as it must be equivalent to twice the beam potential of an ion beam implanter to achieve the same implant depth (specification, page 81, line 22). In fact, depending upon the implant depth, for deeper implant depth the

bias voltage may be 5 kV or more (specification, page 101 line 35 to page 102 line 2). Because arcing or electrical breakdown occurs in or around a conventional wafer pedestal of the type typically employed in an etch reactor at such a high bias voltage level, the applicants provide a special cathode/electrostatic chuck that is impervious to arcing at such high bias voltage levels (specification, page 102 lines 4-56).

Henley et al. ("Henley") and Ishii et al. ("Ishii") individually or in combination do not teach, suggest, or even motivate the elements of claim 1. While Henley concerns plasma immersion ion implantation, Henley does not suggest the separate application of bias voltage or power to the workpiece or to an electrode within the workpiece support pedestal. Ishii is not concerned with plasma immersion ion implantation. Ishii fails to discuss any parameters for selecting the level of the RF bias he applies to his workpiece. Ishii is concerned with a conventional plasma etch reactor and process, and therefore has no particular teachings regarding the level of RF bias voltage or RF bias power applied to his wafer. Plainly, the RF bias voltage level employed in Henley is at a sufficiently low level so that ion bombardment extends only to the workpiece surface, since that is where the etch reaction occurs, and not below the surface. Ishii would have no need to apply a high RF bias voltage. Certainly, Ishii does not suggest the use of a wafer support pedestal capable of withstanding many kV of RF bias voltage without arcing.

There is no motive to combine the teachings of Ishii into Henley. First, they are for different processes (plasma immersion ion implantation versus plasma etch). Secondly, there appear to be no shortcomings in Henley requiring modification to cure. Henley appears to the skilled worker to be sufficient unto

itself and therefore needing no introduction of features from other processes or reactors, such as Ishii's. The motivation to modify Henley with Ishii only arises with hindsight of the present invention.

Finally, even if such a combination were attempted, there are no teachings in either reference to suggest that the ion implantation depth should be controlled by the RF bias voltage applied to the workpiece or pedestal. Medium or deep implant depths could not be achieved in a combination of Henley and Ishii because Ishii makes no provision for avoiding arcing in the wafer support pedestal at high bias power voltage levels (e.g., kV) required for all but the most shallow implant depths. Neither of their reactors would be capable of attaining the requisite bias voltage level corresponding to an ion implant depth. Thus, the suggested combination would lack the feature of Claim 1,

> "controlling ion implantation depth of said species in said workpiece by setting said RF bias to a level corresponding to said desired implant depth".__

Reconsideration of the rejection of Claim 1 is respectfully requested based upon the claim language quoted above.

Second Rejection: Claims 6-11, 15-17, 30, 32-35, 37-43, 60-69, and 83-85 are rejected under 35 USC 103(a) as being unpatentable over Henley et al. (US Pat. No. 6,321,134) in view of Ishii et al. (US Pat. No. 5,571,366), and further in view of Wu et al. (US Pat. No. 4,584,026).

Neither Henley nor Ishii nor Wu teach, suggest or motivate

the elements of Claim 1 discussed above. The combination of Wu with Henley and Ishii has no motivation, because Wu has nothing to do with plasma processing nor with plasma immersion ion implantation because Wu is exclusively concerned with a conventional ion beam implanter. Each one of Claims 6-11, 15-17, 30, 32-35, 37-43, 60-69, and 83-85 specifies a different combination not suggested by the cited references, and is therefore patentably distinguished. For example, Claims 10, 30, 40-43 and 65-69 pertain to features that Wu is incapable of implementing, namely the use of a co-implant element with the implanted species (e.g., in some cases, to remove a cumulative film during implantation). The beam implanter of Wu must be tuned to a particular charge/mass ratio of a single species, and therefore cannot meet the language of Claims 10, 30, 40-43 and 65-69. Claims 10, 30, 40-43 and 65-69 are but some of many example in Claims 6-11, 15-17, 30, 32-35, 37-43, 60-69, and 83-85 in which a new feature not taught for plasma immersion ion implantation in the cited references is claimed. In the interests of brevity, each of these remaining features will not be recited here. Nevertheless, it is important that each of these features is claimed in combination with the element of Claim 1 in which the implant depth is controlled by the RF bias voltage:

> "controlling ion implantation depth of said species in said workpiece by setting said RF bias to a level corresponding to said desired implant depth".__

Such combinations are not suggested or motivated by the cited references and are therefore patentable. Accordingly,

reconsideration of the rejection of Claims 6-11, 15-17, 30, 32-35, 37-43, 60-69, and 83-85 is respectfully requested based upon the unobvious combination of the elements of each of those claims.

SUMMARY

In view of the foregoing corrections and remarks, it is felt that the rejection of the claims under 35 USC 103(a) have been overcome. Therefore, withdrawal of these rejections is respectfully requested and allowance of the application is earnestly solicited.

If the Examiner believes that there are any unresolved issues requiring adverse final action in any of the claims now pending in the application, the Examiner should telephone Robert Wallace at (805) 644-4035 so that appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

Dated: June 11, 2007

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